

## CLAIMS

We claim:

1           1.     A microchannel mixing device for electrohydrodynamic mixing of  
2     fluids, comprising:  
3           a mixing channel, said mixing channel having an inlet for receiving at least  
4     one fluid;  
5           at least one supply channel fluidically connected to said mixing channel inlet  
6     for transport of said fluid into said mixing channel inlet, and  
7           at least two electrodes for imposing an electric field in said mixing channel,  
8     at least one of said electrodes adapted for charging at least a portion of said fluid.

1           2.     The mixing device of claim 1, wherein said at least one supply channel  
2     comprises a first supply channel for a first fluid and a second supply channel for a  
3     second fluid.

1           3.     The mixing device of claim 2, wherein at least one of said electrodes  
2     is disposed within said first or second supply channels.

1           4.     The mixing device of claim 1, wherein at least one of said electrodes  
2     is a fluid isolated electrode disposed in a location which is not in contact with said  
3     fluid.

1           5.     The mixing device of claim 1, wherein said mixing device further  
2     comprises a cover plate in contact with a substrate.

1           6.     The mixing device of claim 5, wherein said mixing channel and supply  
2     channel are formed in said cover plate.

1           7.     The mixing device of claim 5, wherein said cover plate is gas  
2     permeable.

1           8.     The mixing device of claim 5, wherein said substrate comprises silica  
2     or glass.

1           9.     The mixing device of claim 1, further comprising at least one power  
2     supply for applying a DC, pulsed DC or AC voltage to any of said electrodes.

1           10. The mixing device of claim 9, wherein said power supply comprises at  
2 least two independent power supply channels.

1           11. The mixing device of claim 2, wherein said first and second fluids are  
2 mixed in said mixing channel, wherein at least one product is formed from a  
3 reaction.

1           12. The mixing device of claim 1, wherein said electrodes are positioned  
2 along a length of said mixing channel, wherein a potential difference applied  
3 between said electrodes produces an electric field oriented substantially parallel or  
4 anti-parallel to a direction of flow of said fluid in said mixing channel.

1           13. The mixing device of claim 1, wherein said electrodes are positioned  
2 transverse to a length of said mixing channel, wherein a potential difference applied  
3 between said electrodes produces an electric field oriented substantially transverse  
4 to a direction of flow of said fluid in said mixing channel.

1           14. A method for electrohydrodynamically mixing fluids, comprising the  
2 steps of:

3 delivering at least one fluid into a mixing channel;  
4 inducing a charge on at least a portion of said fluid; and  
5 applying an electric field across at least a portion of said mixing channel,  
6 wherein at least one of said fluid is mixed.

1 15. The method of claim 14, wherein said electric field originates or  
2 terminates outside said mixing channel.

1 16. The method of claim 14, further comprising the step of releasing gas  
2 evolved from said applying step.

1 17. The method of claim 16, wherein said releasing step comprises  
2 diffusion across a gas permeable layer.

1 18. The method of claim 14, wherein said applying step comprises  
2 application of a DC voltage.

1 19. The method of claim 14, wherein said applying step comprises  
2 application of a time varying voltage signal.

1           20.   The method of claim 19, wherein said time varying voltage signal  
2 comprises a pulsed DC signal.

1           21.   The method of claim 14, wherein said applying step comprises  
2 applying voltage using at least two independent power supply channels.

1           22.   The method of claim 14, wherein said electric field applied is  
2 substantially parallel or anti-parallel to a direction of flow of said fluid in said mixing  
3 channel.

1           23.   The method of claim 14, wherein said electric field applied is oriented  
2 substantially transverse to a direction of flow of said fluid in said mixing channel.